

Submitted herewith is a Submission Of Marked Up Claims in accordance with 37 C.F.R. § 1.121(c)(1)(ii).

In accordance with 37 C.F.R. 1.136(a), a one month extension of time is submitted herewith to extend the due date of the response to the Office Action dated September 18, 2002, for the above-identified patent application from December 18, 2002, through and including January 21, 2003. In accordance with 37 C.F.R. 1.17(a), authorization to charge a deposit account in the amount of \$110.00 to cover this extension of time request also is submitted herewith.

The rejection of Claims 12, 12, and 13 under 35 U.S.C. § 112, second paragraph, is respectfully traversed.

Claim 10 has been amended to recite “said plurality of large control rods arranged in a staggered row pattern”. Accordingly, Applicants submit that Claims 10, 12, and 13 are definite and particularly point out and distinctly claim the subject matter which Applicants regard as their invention.

For the reasons set forth above, Applicants respectfully request that the Section 112 rejection of Claims 10, 12, and 13 be withdrawn.

The rejection of Claims 1, 4-6, 8-10, 12, and 13 under 35 U.S.C. § 102(b) as being anticipated by Hiraiwa (JP 06-138275) is respectfully traversed.

Claim 1 of the present application recites a core for a nuclear reactor that includes a plurality of independent fuel bundles and a plurality of large control rods. Each independent fuel bundle includes a handle to facilitate lowering the fuel bundle into the core. Each control rod includes four control rod blades extending radially from a central portion and arranged at right

angles to each other. The blades define four fuel bundle receiving channels, and the control rods are arranged in a plurality of staggered rows with only four independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

Applicants submit that Hiraiwa does not describe nor suggest a core for a nuclear reactor as recited in Claim 1. Particularly, Hiraiwa does not describe nor suggest that the control rods are arranged in a plurality of staggered rows with only four independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

As best understood, it appears that Hiraiwa teaches control rods having four control rod blades extending from a central portion with a single fuel bundle in each receiving channel. Applicants submit that Hirawa clearly shows in Figure 4 a single fuel bundle 30A in the receiving channel defined by the control rod blades, and also shows four sub-assemblies 41 that form the single fuel bundle 30A. Applicants submit that Figure 4 clearly shows an outer fuel bundle housing 40 defining a single fuel bundle 30A and surrounding the sub-assemblies 41. Applicants submit that these sub-assemblies are not independent fuel bundles but rather are separate parts held together in the fuel bundle housing to form a single independent fuel bundle.

Applicants submit that the fuel bundle 30A shown in Figure 4 of Hirawa is similar to the fuel bundle described by Taleyarkhan (US 4,649,021). Taleyarkhan describes a single fuel assembly that is formed from four separate sub-assemblies. Each fuel assembly includes a plurality of boxes defining fuel subassemblies. The boxes are connected at one end to a common bottom unit and at the other end to a common top unit to form a single fuel assembly. Each box

contains a plurality of fuel rods. Also, Taleyarkhan shows a single handle to facilitate lowering the fuel assembly into a core. Taleyarkhan does not describe nor suggest, nor does Hirawa describe nor suggest that each sub-assembly includes a handle to facilitate lowering the sub-assembly into a core. Applicants submit that the sub-assemblies shown in Figure 4 of Hirawa like the sub-assemblies described and shown by Taleyarkhan are interdependent and are connected together within an outer housing to form one single fuel assembly. Each sub-assembly of Hirawa or Taleyarkhan cannot be independently removed or lowered into a reactor core because the sub-assemblies are connected together within an outer housing to form a single independent fuel assembly. Accordingly, Applicants submit that Claim 1 is patentable over Hiraiwa.

Claims 4 and 5 depend from independent Claim 1. When the recitations of dependent Claims 4 and 5 are considered in combination with the recitations of Claim 1, Applicants respectfully submit that Claims 4 and 5 likewise are patentable over Hiraiwa.

Claim 6 of the present application recites a core for a nuclear reactor that includes a plurality of fuel cells. Each fuel cell including a large control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other. The blades defining four quadrants of the fuel cell, each quadrant consisting of only four independent fuel bundles. Each independent fuel bundle includes a handle to facilitate lowering the fuel bundle into the core. The plurality of fuel cells are arranged so that the control rods are in a staggered row pattern where each side of each quadrant of a fuel cell is adjacent to a control rod blade.

Applicants submit that Hiraiwa does not describe nor suggest a core for a nuclear reactor as recited in Claim 6. Particularly, and as explained above, Hiraiwa does not describe nor suggest a fuel cell that includes a large control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other with the blades defining four quadrants of the fuel cell, and each quadrant consisting of only four independent fuel bundles. Accordingly, Applicants submit that Claim 6 is patentable over Hiraiwa.

Claims 8-9 depend from independent Claim 6. When the recitations of dependent Claims 8-9 are considered in combination with the recitations of Claim 6, Applicants respectfully submit that Claims 8-9 likewise are patentable over Hiraiwa.

Claim 10 of the present application recites a nuclear reactor core configuration where the core includes a plurality of independent fuel bundles and a plurality of large control rods. Each independent fuel bundle includes a handle to facilitate lowering the fuel bundle into the core. Each control rod includes four control rod blades extending radially from a central portion and arranged at right angles to each other with the blades defining four fuel bundle receiving channels. The configuration comprising the plurality of large control rods arranged in a staggered row pattern, and the fuel bundles arranged with only four independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

Applicants submit that Hiraiwa does not describe nor suggest a core for a nuclear reactor as recited in Claim 10. Particularly, and as explained above, Hiraiwa does not describe nor suggest that the control rods are arranged in a plurality of staggered rows with only four independent fuel bundles in each receiving channel and two sides of each of the four independent

fuel bundles adjacent a control rod blade. Accordingly, Applicants submit that Claim 10 is patentable over Hiraiwa.

Claims 12-13 depend from independent Claim 10. When the recitations of dependent Claims 12-13 are considered in combination with the recitations of Claim 10, Applicants respectfully submit that Claims 12-13 likewise are patentable over Hiraiwa.

For the reasons set forth above, Applicants respectfully request that the Section 102(b) rejection of Claims 1, 4-6, 8-10, 12, and 13 be withdrawn.

The rejection of Claims 1, 4-6, 8-10, 12, and 13 under 35 U.S.C. § 102(b) as being anticipated by Kusuno. (JP 04-296693) is respectfully traversed.

Applicants submit that Kusuno does not describe nor suggest a core for a nuclear reactor as recited in Claim 1, a core for a nuclear reactor as recited in Claim 6, nor a nuclear reactor core configuration as recited in Claim 10. Particularly, Kusuno does not describe nor suggest that the control rods are arranged in a plurality of staggered rows with only four independent fuel bundles in each receiving channel and two sides of each of the four independent fuel bundles adjacent a control rod blade.

As best understood, it appears that Kusuno teaches control rods having four control rod blades extending from a central portion with a single fuel bundle in each receiving channel. Applicants submit that Kusuno clearly shows in Figure 13 a single fuel bundle 1 in the receiving channel defined by the control rod blades (shown in Figure 1), and also shows four sub-bundles 5 that form the single fuel bundle 1. Applicants submit that Figure 13 clearly shows an outer fuel bundle housing 4 defining a single fuel bundle 1 and surrounding the sub-bundles 5. The supplied abstract of Kusuno states that "Fuel assemblies 1 comprising the sub fuel area divided

into pieces and reinforced by structural material are regularly arranged so that water passages 6 filled with reactor water of a # shape may be formed". Applicants submit that this statement shows that Kusuno teaches a single fuel assembly formed by sub-assemblies within an outer housing.

Applicants submit that the fuel bundle 1 shown in Figure 13 of Kusuno is similar to the fuel bundle described by Taleyarkhan (US 4,649,021). Taleyarkhan describes a single fuel assembly that is formed from four separate sub-assemblies. Each fuel assembly includes a plurality of boxes defining fuel subassemblies. The boxes are connected at one end to a common bottom unit and at the other end to a common top unit to form a single fuel assembly. Each box contains a plurality of fuel rods. Also, Taleyarkhan shows a single handle to facilitate lowering the fuel assembly into a core. Taleyarkhan does not describe nor suggest, nor does Kusuno describe nor suggest that each sub-assembly includes a handle to facilitate lowering the sub-assembly into a core. Applicants submit that the sub-assemblies shown in Figure 13 of Kusuno like the sub-assemblies described and shown by Taleyarkhan are interdependent and are connected together within an outer housing to form one single fuel assembly. Each sub-assembly of Kusuno or Taleyarkhan cannot be independently removed or lowered into a reactor core because the sub-assemblies are connected together within an outer housing to form a single independent fuel assembly. Accordingly, Applicants submit that Claims 1, 6, and 10 are patentable over Kusuno.

Claims 4 and 5 depend from independent Claim 1, Claims 8 and 9 depend from independent Claim 6, and Claims 12 and 13 depend from independent Claim 10. When the recitations of dependent Claims 4-5, 8-9, and 12-13 are considered in combination with the

recitations of Claims 1, 6, and 10 respectively, Applicants respectfully submit that Claims 4-5, 8-9, and 12-13 likewise are patentable over Kusuno

For the reasons set forth above, Applicants respectfully request that the Section 102(b) rejection of Claims 1, 4-6, 8-10, 12, and 13 be withdrawn.

The rejection of Claims 1, 4-6, 8-10, 12, and 13 under 35 U.S.C. § 103(a) as being unpatentable over either Hiraiwa or Kusuno in view of Figures 1-3 is respectfully traversed.

As explained above independent Claims 1, 6, and 10 are patentable over Hiraiwa and Kusuno.

Applicants submit that Hiraiwa or Kusuno in combination with Figures 1-3 do not show or suggest a core for a nuclear reactor as recited in Claim 1, a core for a nuclear reactor as recited in Claim 6, or a nuclear reactor core configuration as recited in Claim 10 because neither Hiraiwa, Kusuno, nor Figures 1-3 describe or suggest a core with the control rods arranged in a plurality of staggered rows with only four independent fuel bundles in each receiving channel and two sides of each of the four fuel bundles adjacent a control rod blade. Accordingly, Claims 1, 6, and 10 are submitted to be patentable over Hiraiwa or Kusuno in combination with Figures 1-3.

Claims 4 and 5 depend from independent Claim 1, Claims 8-9 depend from independent Claim 6, and Claims 12-13 depend from independent Claim 10. When the recitations of dependent Claims 4 and 5, and Claims 8-9, and Claims 12-13 are considered in combination with the recitations of Claims 1, 6, and 10 respectively, Applicants respectfully submit that Claims 4, 5, 8-9, and 12-13 likewise are patentable over Hiraiwa, Kusuno and Figures 1-3 of the present application, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1, 4-6, 8-10, 12, and 13 be withdrawn.

The rejection of Claims 1, 4-6, 8-10, 12, and 13 under 35 U.S.C. § 103(a) as being unpatentable over either Hiraiwa or Kusuno in view of Taleyarkhan (US 4,649,021) is respectfully traversed.

As explained above independent Claims 1, 6, and 10 are patentable over Hiraiwa and Kusuno.

Taleyarkhan describes a single fuel assembly that is formed from four separate sub-assemblies. Each fuel assembly includes a plurality of boxes defining fuel subassemblies. The boxes are connected at one end to a common bottom unit and at the other end to a common top unit to form a single fuel assembly. Each box contains a plurality of fuel rods. Also, Taleyarkhan shows a single handle to facilitate lowering the fuel assembly into a core. Taleyarkhan does not describe nor suggest that each sub-assembly includes a handle to facilitate lowering the sub-assembly into a core. Applicants submit that the sub-assemblies shown in Figure 4 of Hirawa and the sub-assemblies shown in Figure 13 of Kusuno, like the sub-assemblies described and shown by Taleyarkhan are interdependent and are connected together within an outer housing to form one single fuel assembly. Each sub-assembly of Hirawa, Kusuno, or Taleyarkhan cannot be independently removed or lowered into a reactor core because the sub-assemblies are connected together within an outer housing to form a single independent fuel assembly. Accordingly, Applicants submit that Claims 1, 6, and 10 are patentable over Hirawa, Kusuno, and Taleyarkhan, alone or in combination.



Claims 4 and 5 depend from independent Claim 1, Claims 8-9 depend from independent Claim 6, and Claims 12-13 depend from independent Claim 10. When the recitations of dependent Claims 4 and 5, and Claims 8-9, and Claims 12-13 are considered in combination with the recitations of Claims 1, 6, and 10 respectively, Applicants respectfully submit that Claims 4, 5, 8-9, and 12-13 likewise are patentable over Hiraiwa, Kusuno and Taleyarkhan, alone or in combination.

For the reasons set forth above, Applicants respectfully request that the Section 103(a) rejection of Claims 1, 4-6, 8-10, 12, and 13 be withdrawn.

In view of the foregoing amendments and remarks, all the claims now active in this application are believed to be in condition for allowance. Favorable action is respectfully solicited.

Respectfully submitted,

A handwritten signature in cursive script, reading "Michael Tersillo", written over a horizontal line.

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PATENT

## IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: Challberg et al. :  
 Serial No.: 09/597,113 : Art Unit: 3641  
 Filed: June 20, 2000 : Examiner: J. Keith  
 For: CORE CONFIGURATION FOR A :  
 NUCLEAR REACTOR :

## SUBMISSION OF MARKED UP CLAIMS

Hon. Commissioner for Patents  
 Washington, D.C. 20231

A marked-up version of amended Claims 1, 6, and 10, in accordance with 37 C.F.R.  
 § 1.121(c)(1)(ii), follows below.

MARKED UP CLAIMS

1. (thrice amended) A core for a nuclear reactor comprising:
- a plurality of independent fuel bundles, each said independent fuel bundle comprising a handle to facilitate lowering said fuel bundle into said core; and
- a plurality of large control rods, each said control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other, said blades defining four fuel bundle receiving channels, said control rods arranged in a plurality of staggered rows with only four independent fuel bundles in each said receiving channel and two sides of each of said four independent fuel bundles adjacent a control rod blade.
6. (twice amended) A core for a nuclear reactor comprising a plurality of fuel cells, each said fuel cell comprising;

a large control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other, said blades defining four quadrants of said fuel cell, each said quadrant containing only four independent fuel bundles, each said independent fuel bundle comprising a handle to facilitate lowering said fuel bundle into said core;

said plurality of fuel cells arranged so that said control rods are in a staggered row pattern where each side of each said quadrant of a fuel cell is adjacent to a control rod blade.

10. (thrice amended) A nuclear reactor core configuration, said core comprising a plurality of independent fuel bundles and a plurality of large control rods, each said independent fuel bundle comprising a handle to facilitate lowering said fuel bundle into said core, each said control rod comprising four control rod blades extending radially from a central portion and arranged at right angles to each other, said blades defining four fuel bundle receiving channels, said configuration comprising:

said plurality of large [fuel bundles] control rods arranged in a staggered row pattern; and

said fuel bundles arranged with only four independent fuel bundles in each said receiving channel and two sides of each of said four independent fuel bundles adjacent a control rod blade.

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